considerable depth. There is good timber at the western extremity of Bluff Harbour, and between it and the river Eurete some extent of bush land, in and around which a herd of cattle finds sufficient pasture, but feeding chiefly on the milk thistle, &c. There is a small community of Europeans at the Bluff and at the Aparima, who have intermarried with the natives, and who, pursuing whaling, sealing, and husbandry, and in a few instances stock-keeping, have attained to very comfortable circumstances. Some were in the practice of growing wheat, but they informed me that the climate was unfavourable, rains being frequent and copious, and the gales of wind boisterous. While my vessel lay at anchor in the Eurete, in the month of May, we had to encounter, in the surveys executed and our several exploratory journeys, very inclement weather. Considering then the climate, the soil, and the natural growth, I am convinced that there is no very eligible site for a future settlement south of the Mataura river and Tuturau; a favourite residence of the natives formerly, when they were more numerous, because it afforded shelter from the southern climate, good fishing and fertile land. From Tuturau north to Otago there is an unbroken tract of fertile and well-watered land, affording abundant pasture and much of it of excellent quality for tillage. It abounds with supplies of coal, wood, timber, brick-earth, stone, conveniently dispersed through the district, and very accessible by the facilities of inland navigation which its rivers and lakes afford. Again:—For fifty miles north of Otago there is a district presenting almost equal capabilities for large productiveness. Further north, along the ninety miles beach, extending about twenty-eight miles above Banks Peninsula, there is a vast plain, for the most part either too arid and stony or too wet and swampy to be eligible for occupation. There is but a very limited quantity of fertile land good enough for tillage within a distance of twenty miles of either of the harbours of Banks Peninsula. The surfaces of plains in New Zealand usually present a succession of terraces in lines parallel with the courses of the rivers, rising in steps of from 6 ft. to 14 ft. in elevation. Much of the surface is desolated by a closely-imbedded boulder and shingle: and usually where these occur of the greatest breadth, and where is a dead level, the surface is the most stony. On the hill lands of Banks Peninsula there is good pasture; but it is not so on the plain. My reasons for rejecting it as ineligible for the site of a settlement, as well as my Report of the entire journey of exploration which I made in 1844, are alluded to in the Seventeenth Report of the Directors of the New Zealand Company, and the substance of the same will be presented to the public under the head of 'Topography of the Middle Island of New Zealand' in the work on British Colonies written by Mr. R. M. Martin."—Ed.

V.—*Remarks on the use of the Aneroid Barometer.*—By Colonel Philip Yorke, F.R.S., F.R.G.S.

[Read Feb. 10, 1851.]

The portability and facility of observing the aneroid barometer has of late occasionally induced travellers to substitute it for the mercurial barometer in meteorological observations, and for obtaining differences of level. But before the value of such observations can be estimated, it seems necessary that comparative observations of the aneroid with the ordinary barometer should be made under different circumstances.

As I had not heard that such a series of observations had been made, I employed some time during the past summer in an attempt to supply the desideratum. For this purpose I provided myself with a portable barometer (of Fortin's construction), made by Barrow, and an aneroid obtained from Messrs. Watkins and Hill, which was furnished with a thermometer and with a vernier reading to 1-500th of an inch.

The observations were carried on during 115 days, partly in London and in Herefordshire, and partly during a tour in France; these are recorded in the following tables. The barometer is reduced to 32° Fahr., and corrected for capillary action. The 7th column shows the difference observed between the two instruments, that obtained by the first comparison being reckoned as = 0. It should be observed that the portable barometer was also compared with a fixed standard instrument in Eaton-place, before going to, and after returning from Herefordshire, as recorded in table II. And as the portable barometer was broken in the tour abroad, the aneroid was compared on return with the standard brometer, corrected to the level of the portable (see Table III.), by means of the previous comparison.

On examining the observations, it will be seen that when the instrument is at rest the difference between it and the barometer gradually increases, though in an irregular manner. Thus, at Perristone, the station in Herefordshire, on July 9th, the difference, reckoning from the assumed zero, is + ·018, while on August 6 it has risen to about + ·080. This particular instrument when remaining in the same place always increased its error in the same direction, viz. by indicating too high a pressure. The motion occasioned by travelling appears to produce a difference sometimes in one direction and sometimes in the other. The greatest variation (probably arising from the motion) in a short time is shown by the observation at Clermont, August 19, diff. = + ·041, and at Mont d'Or les Bains, August 20, diff. = − ·025, the variation = 066 in. The extreme amount of variation shown during the whole time is from the lowest point at Mont d'Or, on August 22 (diff. = — ·108), to the highest at Eaton-place, October 20 (diff. = + ·143*) = ·251.

If we examine the observations made on the Puy de Pariou, and at Clermont, before and after the ascent, for the purpose of comparing the capability of the aneroid with that of the mercurial barometer, for determining by such means differences of level, we find the mean of the two observations at Clermont with

* This difference is now, January 27, 1851, = ·202, making the total variation from the assumed zero in 7 months = ·31 in.

the barometer giving the pressure = 28·778 in., and on the Puy = 26·145, diff. = 2·630 in.

With the aneroid the corresponding observations at Clermont give 28·906 in.; on the Puy, 26·286 in.; diff. 2·62. The difference between the results of the two instruments is only = ·01 in., about 9 feet in level.

Similar observations at Clermont and on the summit of the Puy de Dome give for the difference, with the barometer, 3·440 in., and with the aneroid 3·466. The difference of result between the two instruments is therefore ·026 in. = about 24 feet. In the observations of like nature which were made on the Pic de Sancy, the barometrical observation is defective, owing to the cistern containing so much mercury that the level of the mercury therein could not descend quite to that of the ivory point; so that the column of mercury actually stood somewhat lower than what is registered. Yet the aneroid shows a pressure = ·064 in. higher than that which the barometer indicates on the summit, and the difference of result between the two instruments (obtained as in the previous observations) is = ·12 in. This observation, then, seems to show that we have now arrived at a point in the scale of the aneroid (24· in.) where the indications begin to err from defect in the elasticity of the metallic vessel, on which the atmospheric pressure originates motion in the instrument. On the Pic du Midi the error of the same kind is certainly more than 8-10 in. But here the height demands that a lower pressure should be indicated than is pretended to be reached by the graduation of the instrument.

These observations lead me then to conclude—1st, that the aneroid may be used satisfactorily when sudden changes of atmospheric pressure is what is required to be shown; 2nd, that it may occasionally be usefully employed to determine differences of level to within a probable error equal to ·03 in. or ·04 in. of mercury, when it can be compared before and after the observations, and within about 24 hours, with a good ordinary fixed barometer reading to 1-100th of an inch. When the aneroid is to be used for such purposes it should be carefully compared previously with the barometer at low pressures under an air-pump. It must always be observed in the same position. I find that mine stands ·033 in. lower when suspended vertically than when in a horizontal position. It should be furnished with a vernier to read to 1-100th of an inch; but it is useless to carry the division further. Finally, that it cannot be depended on for any length of time, as an independent instrument, for observations intended to show the atmospheric pressure.

Table I.

Journal of Comparative Observations made with the Aneroid and Mercurial Barometer in the Summer of 1850.

Date.	Temperature of Air.	Thermometer to Aneroid.	Aneroid Barometer.	Barometer.	Diff. 1.	Diff. 2.
Eaton Place. Lat. 51° 30′ N.; Long. :—						
h. m.						
June 30, 11 15 A.M.	..	65	30·242	29·965	0·277	0·000
,, 30, 3 15 P.M.	..	66	30·244	29·967	0·277	0·000
July 1, 9 0 A.M.	..	65	30·180	29·888	0·292	+·015
,, 1, 5 0 P.M.	..	65	30·174	29·886	0·288	+0·001
,, 2, 12 0 ,,	..	66	30·192	29·890	0·292	+·015
,, 2, 1 40 ,,	..	40	30·176	29·887	0·289	+·012*
,, 2, 2 30 ,,	..	36·5	30·180	29·894	·286	+·009
,, 2, 3 20 ,,	..	36	30·180	29·895	·285	+·008
,, 3, 11 0 A.M.	..	65	30·054	29·743	·311	+·034
,, 3, 12 0 ,,	..	65	30·058	29·764	·294	+·017
,, 3, 1 20 P.M.	..	90	30·024	29·769	·255	—·022†
,, 3, 6 0 P.M.	..	68	30·170	29·884	·286	+·009
,, 4, 1 30 P.M.	..	65	29·860	29·754	·106	·000‡
,, 4, 9 0 ,,	..	64	30·012	29·913	·099	—·007
,, 5, 9 0 A.M.	..	62	30·180	30·088	·092	—·014
	..	68	30·194	30·101	·093	—·013
Perristone. Lat. 51° 55′ N.; Long. :—						
July 9, 11 50 A.M.	..	63	29·658	29·534	·124	+·018
,, 9, 2 20 P.M.	..	63	29·635	29·518	·117	+·011
Top of Perristone Hill:—						
July 9, 3 20 P.M.	..	60	29·480	29·358	·122	+·016
Perristone House:—						
July 9, 4 10 ,,	..	64	29·628	29·518	·110	+·004
,, 10, 9 0 A.M.	..	62	29·706	29·588	·118	+·012
,, 10, 12 0 ,,	..	63	29·694	29·573	·121	+·015
,, 11, 9 0 ,,	..	66	29·696	29·576	·120	+·014
,, 11, 3 0 P.M.	..	67	29·706	29·586	·120	+·014
,, 11, 11 30 ,,	..	68	29·726	29·609	·117	+·011
,, 12, 9 0 A.M.	..	67·5	29·728	29·607	·121	+·015
,, 12, 3 0 P.M.	..	70	29·670	29·552	·118	+·012
,, 13, 9 0 A.M.	..	69	29·666	29·546	·120	+·014
,, 13, 2 30 P.M.	71	71	29·640	29·525	·115	+·009
,, 14, 9 0 A.M.	60	67·5	29·702	29·589	·113	+·007
,, 15, 9 0 ,,	69	68·5	29·608	29·491	·117	+·011
,, 15, 3 0 P.M.	..	72	29·536	20·416	·120	+·014
,, 16, 3 0 A.M.	..	74	29·534	29·411	·123	+·017
,, 17, 9 0 ,,	71	71	29·534	29·405	·129	+·023
,, 17, 3 0 P.M.	75	74	29·508	29·377	·121	+·015

* Aneroid put into a cooling vessel.
† Aneroid put into a heating vessel.
‡ Aneroid re-adjusted.

TABLE I.—*continued.*

Date.	Temperature of Air.	Thermometer to Aneroid.	Aneroid Barometer.	Barometer.	Diff. 1.	Diff. 2.
Perristone House:—						
h. m.						
July 18, 9 0 A.M.	68	71·5	29·596	29·469	·127	+·021
,, 18, 3 0 P.M.	··	72·5	29·572	29·437	·135	+·029
(Thunder-storm.)						
,, 19, 9 0 A.M.	68	70	29·608	29·475	·133	+·027
,, 19, 3 0 P.M.	··	72	29·592	29·439	·153	+·047
,, 20, 9 0 A.M.	63	68	29·612	29·468	·142	+·036
,, 20, 3 0 P.M.	67·5	70·5	29·576	29·435	·141	+·035
,, 21, 9 0 A.M.	66	68	29·576	29·436	·140	+·034
,, 21, 2 0 P.M.	··	72	29·554	29·412	·142	+·036
,, 21, 11 0 P.M.	··	69	29·572	29·425	·147	+·041
,, 22, 9 0 A.M.	70	68	29·552	29·412	·140	+·034
,, 22, 3 0 P.M.	··	70	29·522	29·379	·143	+·037
,, 23, 9 0 A.M.	72	71·5	29·434	29·289	·145	+·039
,, 23, 12 0 ,,	73	74	29·398	29·251	·147	+·041
,, 23, 3 0 P.M.	67	72	29·426	29·281	·145	+·039
,, 24, 9 0 A.M.	61·5	66	29·572	29·417	·155	+·049
,, 24, 3 0 P.M.	64	72	29·540	29·394	·146	+·040
,, 25, 9 0 A.M.	55	65	29·334	29·182	·152	+·046
,, 25, 12 0 ,,	60	64	29·246	29·088	·158	+·052
,, 25, 3 0 P.M.	··	64	29·258	29·096	·162	+·056
,, 26, 9 0 A.M.	62	63	29·346	29·196	·150	+·044
,, 26, 12 0 ,,	64	63·5	29·362	29·214	·148	+·042
,, 26, 3 0 P.M.	65	64	29·380	29·230	·150	+·044
,, 26, 3 47 ,,	66·5	70	29·790	29·653	·137	+·031*
,, 26, 5 15 ,,	62	70	29·392	29·236	·156	+·050†
,, 27, 9 0 A.M.	58·5	63	29·442	29·286	·136	+·050
,, 27, 11 0 P.M.	··	64	29·588	29·430	·158	+·052
,, 28, 9 0 A.M.	62	62·5	29·672	29·514	·158	+·052
,, 28, 11 0 P.M.	··	65	29·756	29·596	·160	+·054
,, 29, 9 0 A.M.	61	64	29·792	29·628	·164	+·058
,, 29, 3 30 P.M.	63	64	29·796	29·639	·157	+·051
,, 30, 9 0 A.M.	64	65	29·882	29·726	·156	+·050
,, 30, 3 0 P.M.	70	65	29·850	29·689	·161	+·055
,, 31, 9 0 A.M.	63	68	29·804	29·637	·167	+·061
August 1, 9 0 ,,	62	68·5	29·862	29·701	·161	+·055
,, 2, 9 0 ,,	66	68	29·754	29·585	·169	+·063
,, 2, 3 0 P.M.	71	70	29·722	29·547	·175	+·069
,, 3, 9 0 A.M.	68	68·5	29·728	29·555	·173	+·067
,, 3, 3 0 P.M.	72	72·5	29·684	29·513	·171	+·065
,, 4, 9 0 A.M.	65	68	29·546	29·365	·181	+·075
,, 4, 6 0 P.M.	··	67·5	29·470	29·283	·187	+·081
,, 5, 9 0 A.M.	62	66	29·390	29·202	·188	+·082
,, 5, 3 0 P.M.	65	68	29·332	29·150	·182	+·076
,, 6, 9 0 A.M.	62	63	29·430	29·248	·182	+·076
Eaton Place:—						
August 6, 9 0 P.M.	64	70	29·908	29·732	·176	+·070
,, 7, 12 0 A.M.	··	70	30·074	29·901	·173	+·067

* By the river Wye. † At the house.

TABLE I.—*continued.*

Date.	Temperature of Air.	Thermometer to Aneroid.	Aneroid Barometer.	Barometer.	Diff. 1.	Diff. 2.
Eaton Place:—						
h. m.						
Aug. 8, 9 0 A.M.	..	69	29·928	29·741	·187	+·081
,, 9, 9 0 ,,	..	66	29·900	29·718	·182	+·076
Paris. Lat. 48° 50′; Long. 2° 20′ E.:—						
Aug. 11, 11 0 P.M.	..	73	29·896	29·697	·199	+·093
,, 12, 9 0 A.M.	66	69	29·874	29·657	·217	+·111
,, 12, 4 0 P.M.	..	70	29·810	29·616	·194	+·088
,, 13, 9 0 A.M.	64	69	29·900	29·704	·196	+·090
Clermont, Hôtel de l'Ecu. Lat. 45° 47′ N.; Long. 3° 5′ E.						
Aug. 16, 9 0 A.M.	..	69	28·844	28·697	·147	+·041
,, 17, 9 0 ,,	70	69	28·954	28·806	·148	+·042
,, 18, 9 0 ,,	71	72	28·964	28·814	·150	+·044
,, 18, 1 15 P.M.	72	72	28·926	28.776	·150	+·044
Summit of Le Puy de Pariou:—						
Aug. 18, 4 40 P.M.	58	64	26·286	26·145	·141	+·035
Clermont, on return:—						
Aug. 18, 6 45 P.M.	71	70	28·886	28·775	·111	+·005
Aug. 19, 9 0 A.M.	75	72	28·854	28·734	·120	+·014
Summit of the Puy de Dome:—						
Aug. 19, 1 30 P.M.	59	69	25·368	25·260	·108	+·002
Clermont:—						
Aug. 19, 5 20 P.M.	73	73	28·814	28·667	·147	+·01
Mont d'Or les Bains:—						
Aug. 20, 10 0 P.M.	..	60	26·556	26·475	·081	−·025
,, 21, 9 0 A.M.	64	64	26·402	26·325	·077	−·029
Summit of Pic du Sancy:—						
Aug. 21, 1 30 P.M.	53·5	62	24·024	23·854*	·170	+·064
Mont d'Or les Bains:—						
Aug. 21, 4 30 P.M.	63	64	26·348	26·324	·024	−·082
,, 21, 9 30 ,,	..	..	26·444	26·406	·038	−·068
,, 22, 9 0 A.M.	60	63	26·450	26·452	−·002	−·108
,, 22, 12 0 ,,	..	64	26·454	26·450	+·004	−·102
,, 22, 9 0 P.M.	..	65	26·410	26·384	·026	−·080
Clermont:—						
Aug. 24, 9 0 A.M.	58·5	66	28·770	28·715	·055	−·051

* Observation defective owing to Mercury in the cistern not descending to the level of the ivory point.

TABLE I.—*continued.*

Date.	Temperature of Air.	Thermometer to Aneroid.	Aneroid Barometer.	Barometer.	Diff. 1.	Diff. 2.
Le Puy. Lat. 45° 3′ N.; Long. 3° 53′ E.:—						
Aug. 25, 12 0 A.M.	64	65	28·122?	28·195	−·073	−·179
,, 25, 9 0 P.M.	••	67	28·188	28·156	+·032	−·074
,, 26, 9 0 A.M.	63	64	28·186	28·150	·036	−·070
,, 27, 9 0 ,,	65	66	28·192	28·161	·031	−·075
Aubenas:—						
Aug. 28, 10 0 A.M.	71·5	71	29·136	29·090	·046	−·064
,, 29, 9 0 ,,	70	70	29·016	28·900	·102	−·050
,, 29, 3 0 P.M.	76	73	29·010	28·908	·102	−·004
Nimes. Lat. 43° 50′ N.; Long. 4° 21′ E.:—						
Aug. 31, 9 0 A.M.	67	73	30·022	29·940	·082	−.024
Sept. 2, 9 0 ,,	69	71	30·268	30·183	·085	−·021
,, 3, 9 0 ,,	69	72	30·246	30·148	·098	−·008
,, 6, 9 0 ,,	69	72	30·102	39·938	·164	+·058
Montpellier. Lat. 43° 36′ N.; Long. 3° 52′ E.:—						
Sept. 7, 9 0 A.M.	66	69	30·170	30·004	·166	+·060
,, 7, 3 50 P.M.	73	71	30·104	29·944	·160	+·054
Toulouse. Lat. 43° 30′ N.; Long. 1° 26′ E.:—						
Sept. 9, 12 30 P.M.	64	65	29·764	29·629	·135	+·029
Bagnères de Bigorre. Lat. 43° 4′ N.; Long. 0° 9′ E.:—						
Sept. 11, 9 0 P.M.	••	72	28·190	28·112	·078	−·028
,, 12, 9 0 A.M.	71	70	28·160	28·066	·094	−·012
,, 12, 12 0 ,,	64·5	69	28·184	28·086	·074	−·032
,, 13, 9 0 ,,	64	67	28·218	28·120	·088	−·018
,, 13, 2 0 P.M.	66	69	28·196	28·118	·078	−·028
,, 14, 9 0 A.M.	62	65	28·142	28·031	·111	+·005
,, 14, 3 0 P.M.	66	67	28·120	28·017	·103	−·003
,, 15, 9 0 A.M.	63	65	28 088	27·981	·107	+·001
,, 15, 3 0 P.M.	63	66	28·106	27·992	·108	+·002
,, 16, 9 0 A.M.	57·5	64	28·152	28·053	·099	−·007
,, 17, 9 0 ,,	62	63	28·236	28·130	·106	·000
,, 18, 9 0 ,,	57	••	28·236	28·130	·106	·000
,, 18, 3 30 P.M.	59	65	28·194	28·089	·105	−·001
Grip:—						
Sept. 18, 6 45 P.M.	54	62	26·706	26·576	·130	+·024
,, 19, 7 30 A.M.	52	57	26·620	26·486	·134	+·028
Summit of Pic du Midi:—						
Sept. 19, 12 0 A.M.	47	45	22·050	21·1*	·95 0	+·844

* Barometer broken before final reading.

TABLE II.

Comparison between Standard Barometer (Newman's) and Portable Barometer (Barrow's), both reduced to 32° Fahr. and corrected for Capillary Action.

Date.	Standard Barometer.	Portable Barometer.	Difference.
Eaton Place :—			
July 1	29·797	29·808	+·011
,, 2	29·804	29·815	+·011
,, 2	29·866	29·880	·014
Aug. 6	29·722	29·730	·008
,, 7	28·821	29·833	·012
	..	..	+·011

TABLE III.

Comparison between Aneroid Barometer and Newman's Standard, reduced to 32° Fahr. and to Portable Barometer.

Date.	Standard Barometer.	Aneroid Barometer.	Diff. 1.	Diff. 2.
Eaton Place :— h. m.				
Oct. 20,	29·871	30·120	·249	.143
,, 21, 1 0 P.M.	29·957	30·186	·229	·123
,, 21, 10 0 ,,	30·086	30·306	·220	·114
,, 22, 10 0 ,,	29·842	30·062	·226	·120
,, 23, 3 0 ,,	29·161	29·408	·247	·141

VI. — *On the Adaptation of the Aneroid for the purposes of Surveying in India.* By GEORGE BUIST, LL.D., F.R.S., Corresponding Member of the Royal Geographical Society of London. Communicated by Col. SYKES, F.R.S., F.R.G.S.

[Read February 24, 1851.]

ONE of the great desiderata with travellers is to be able to obtain an instrument for measuring elevations of moderate size, consider-